CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES
Ottawa

GENERATOR LAKE, BAFFIN ISLAND, N.W.T. and TASIUJAQ COVE, EKALUGAD FIORD, BAFFIN ISLAND, N.W.T. 1968

No. 1

1970 Data Record Series

Canadian Oceanographic Data Centre

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CANADIAN OCEANOGRAPHIC DATA CENTRE

ERRATA

TO

Publication No. 1, 1970 Data Record Series. Generator Lake, Baffin Island, N.W.T. and Tasiujaq Cove, Ekalugad Fiord, Baffin Island, N.W.T.

<u>Page 13</u> The last phrase in the penultimate paragraph should read .... immediately south of the lake basin.

<u>TABLE 3 (continued)</u> Insert between pages 38 and 39.

A reproduction of oceanographic plotting sheet number CHS 750 showing the location of Generator Lake and Ekalugad Fiord.

LIST OF FIGURES

LIST OF TABLES

SECTION I

GENERATOR LAKE, BAFFIN ISLAND

GEOLOGICAL SURVEY OF CANADA

Generator Lake, Baffin Island

Period of Survey: May 30 - August 16, 1968

Observers: D.M. Barnett
D.L. Forbes
J.K. Whytock

Division of Quaternary Research and Geomorphology

Plate 1 Aerial photograph (A-17042-129) of part of Barnes Ice Cap (left) and part of Generator Lake (from RCAF photo taken July 19, 1961 from 30,000 feet with a 6 inch lens).

GENERATOR LAKE

The data presented here were collected from Generator Lake (frontispiece) as part of a proglacial geomorphology project (680040) of the Quaternary Research and Geomorphology Division of the Geological Survey of Canada; the data are also being used in the preparation of a thesis to be presented to the University of Western Ontario. The development, landforms, and chronology of Generator Lake have been described by Barnett (1967) and further progress reported in Barnett (1969).

Most investigations of the lake environment were made through several feet of lake ice. During the summer of 1966 five bathymetric profiles (Fig. 1) were obtained using a Kelvin-Hughes M.S.26B echo-sounder. Profiles 2 and 7 are shown in Figure 2. Four additional profiles were run in 1968, together with the collection of bathythermograph data, water samples by Knudsen bottle, bottom temperatures by reversing thermometers and sediment sampling by Dietz-Lafond grab at selected stations. A total of 26 bathythermograph traces were collected, 21 water samples and 20 bottom sediment samples. The station positions are shown in Fig. 3 and an interpretation (by DMB) of the bathymetric data in Fig. 4. Additional line sounding data, collected in August 1969 were used to clarify some details in areas less than 20 m. deep.

Generator Lake is located on the interior upland of north-central Baffin Island at an elevation close to 400 metres. It occupies the upper valley of a consequent stream which prior to the last glaciation drained westward into Foxe Basin but which is currently dammed by the Barnes Ice Cap, causing overflow waters to spill eastward to Baffin Bay by way of the Clyde River. The lake's maximum dimensions at present are 13.5 km by 6.5 km; it drains over 400 km^2 of ice-free land and part of the Barnes Ice Cap. The greatest depth sounded was 60.5 metres at a point close to the ice cliffs on profile 3 of Fig. 1.

A preliminary analysis of the bedrock geology of the area has been presented by Jackson (1969); granitoid migmatites and gnesses predominate with some iron formation immediately south of the lake basin.

Climatically the area is sufficiently cold to maintain lake ice cover of almost two metres and it is only rarely that the lake surface becomes ice-free, as it did on August 23, 1966, and again on August 26, 1969.

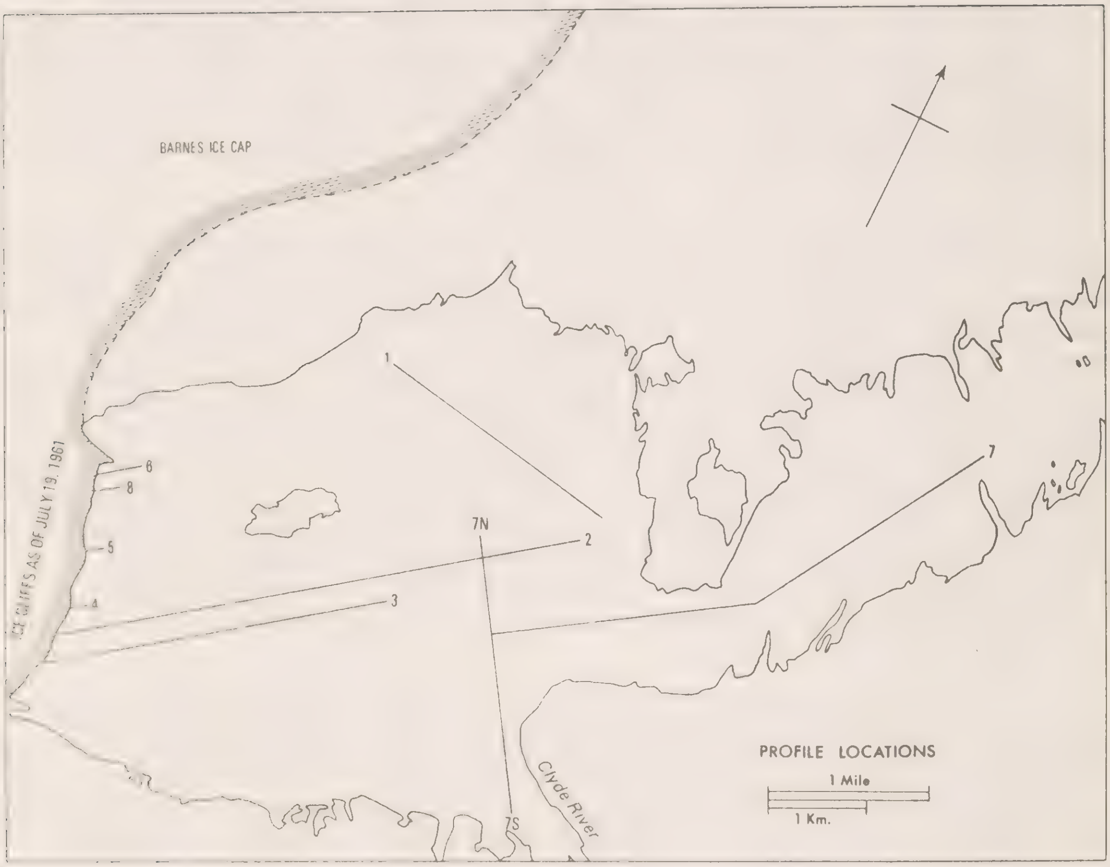

Figure 1 Location of profiles in Generator Lake along which echo sounder observations were made.

The Barnes Ice Cap, which is thought to be a remnant of the last Wisconsin ice sheet has been the subject of glaciological studies for several years (Baird, 1952; Ward, 1952; Sagar, 1966; Løken and Andrews, 1966; Løken and Sagar, 1968) and a related study by Barry and Fogarasi (1968) presented climatological findings designed to develop models for conditions favouring glacierization. As current theory suggests at least the land-based margin of the Barnes Ice Cap is frozen to its base, the thermal distribution of Generator Lake waters is of interest to other investigations of this proglacial environment.

D.M. Barnett

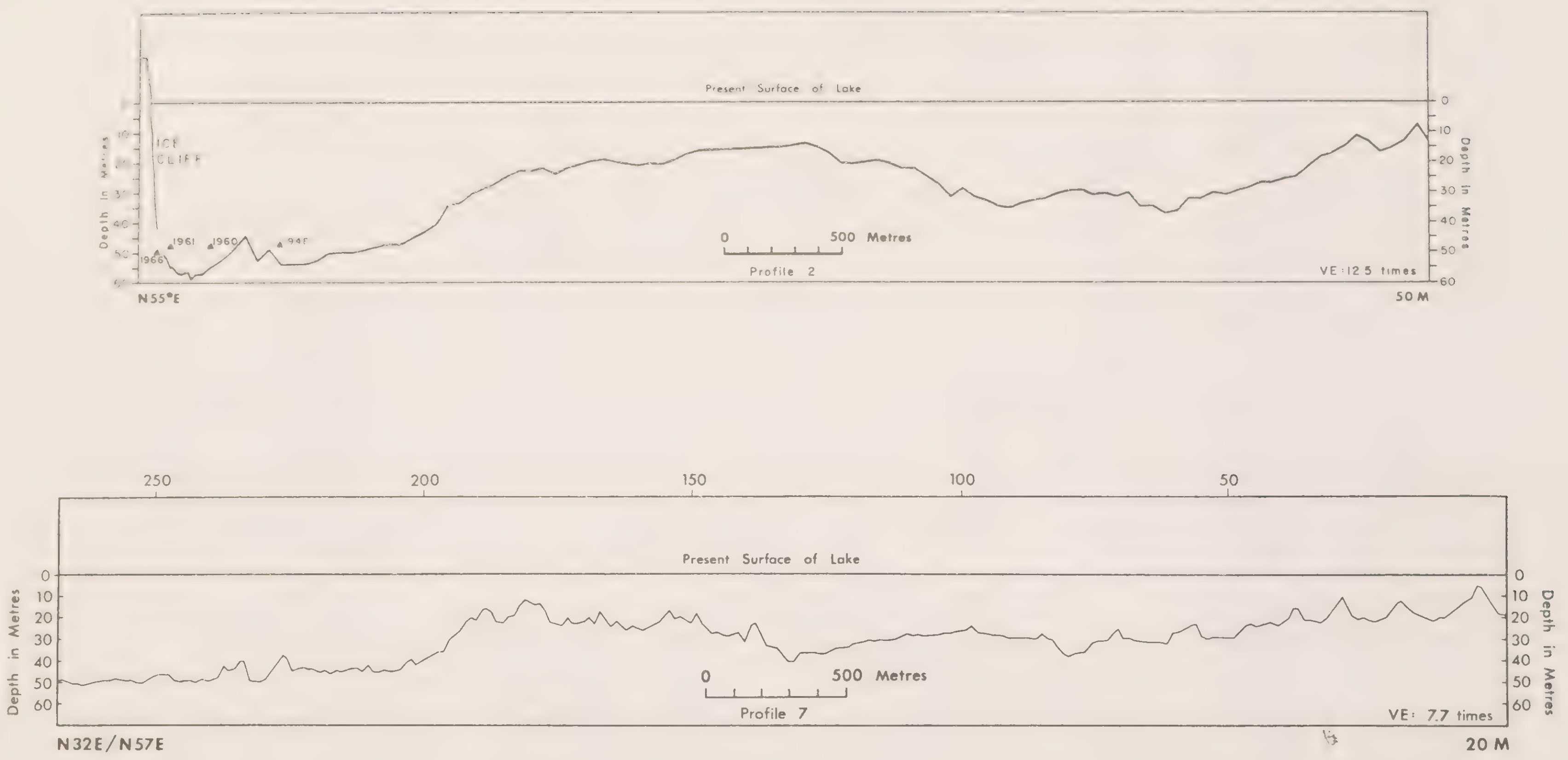

Figure 2 Profiles 2 and 7 showing bottom morphology.

Plate 2 Gasoline powered drill with 4 inch bit. A five hole pattern was drilled and then the centre chiselled out. Note candling of upper few centimeters of ice.

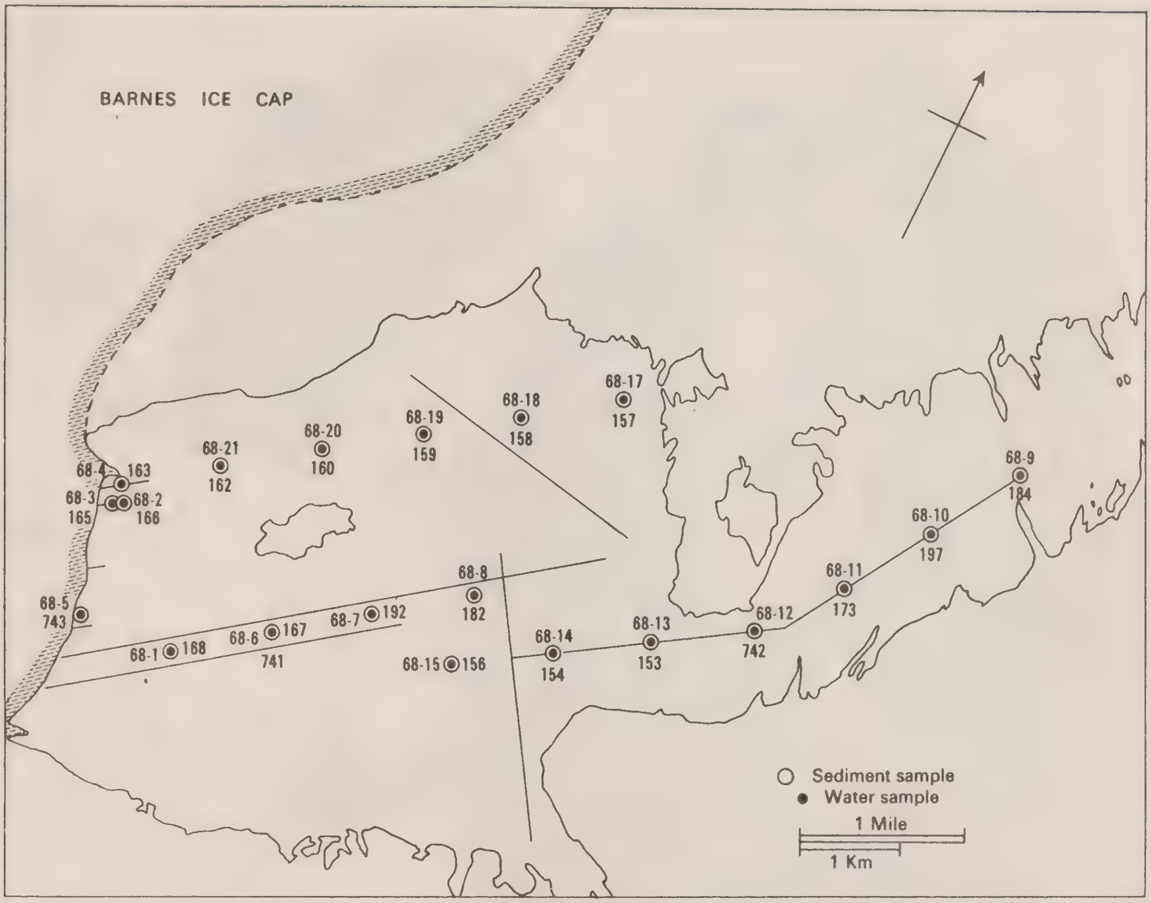

Figure 3 Locations in Generator Lake at which sediment samples and water samples were obtained.

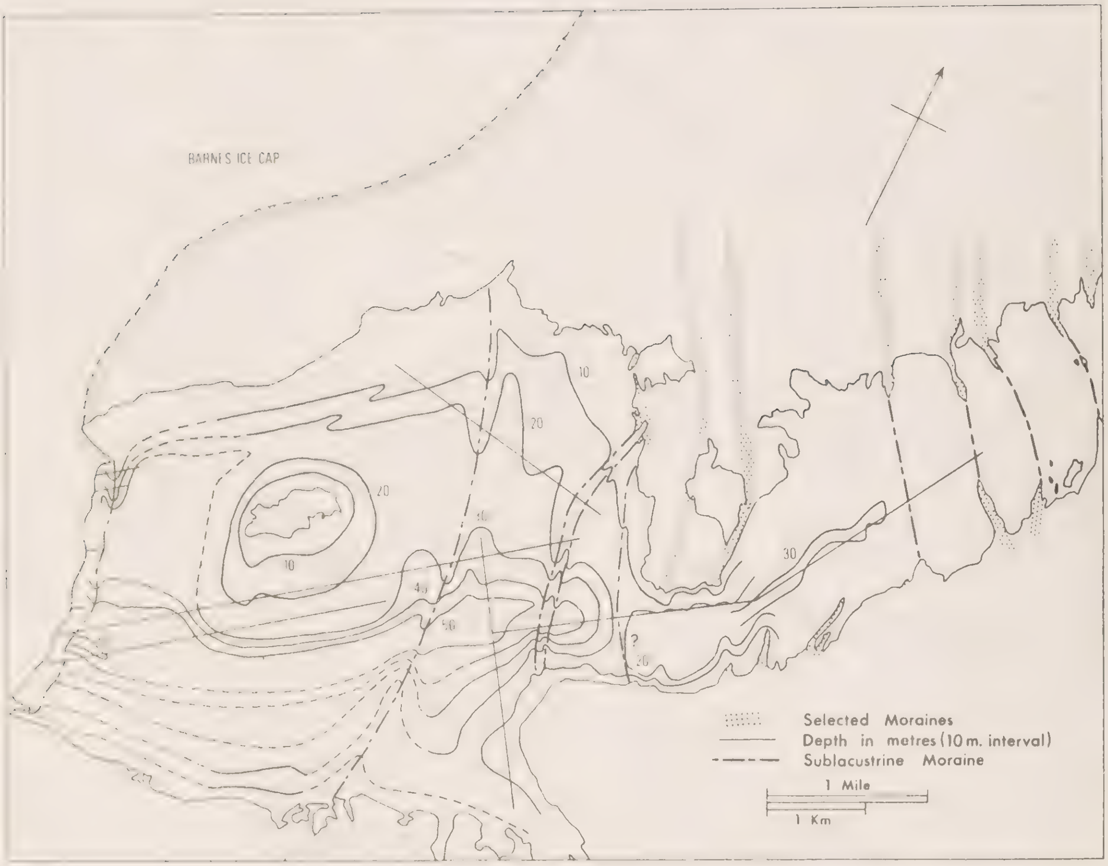

Figure 4 Bathymetry in metres of Generator Lake as interpreted (by DMB) from the echo sounder data, and related geomorphological investigations.

Plate 3 Preparing to lower the Dietz-Lafond grab sampler. The power winch was used for retrieval at slow speed.

TABLE 1

Water Chemistry of Bottom Samples from Generator Lake

DATE (1968)	WATER SAMPLE (No)	DEPTH (m)	LAB. TEMP (°C)	COND (m/mho)	HARD	Ca	Mg	Na	K	Cl	NO_3	Sio_3
July 23	153	37	24.5	16.9	3.0	0.75	0.26	1.3	0.3	1.5	0.14	1.8
July 23	154	44.5	24.5	13.4	2.0	0.50	0.20	1.0	0.3	1.0	0.18	1.8
July 23	156	33	24.5	15.3	3.5	1.0	0.24	1.0	0.3	0.8	0.14	1.8
July 27	157	16.5	24.5	16.9	2.3	0.50	0.26	1.3	0.3	0.8	0.20	1.8
July 27	158	23.5	24.9	14.7	2.1	0.50	0.22	1.1	0.3	0.8	0.14	1.6
July 27	159	24	24.9	14.9	2.1	0.50	0.22	1.2	0.4	0.7	0.10	1.7
July 27	160	19	24.8	16.8	2.3	0.50	0.26	1.1	0.3	0.7	0.13	1.6
July 27	162	27.5	24.8	16.9	2.2	0.55	0.20	1.1	0.3	0.8	0.11	1.6
July 27	163	16	24.9	16.5	2.1	0.50	0.22	0.9	0.3	0.6	0.13	1.5
July 27	165	20	24.8	14.8	2.3	0.55	0.22	1.0	0.3	0.7	0.14	1.7
July 27	166	30	24.9	14.6	2.1	0.50	0.22	1.0	0.3	0.8	0.17	1.4
July 27	167	52	24.9	15.1	2.2	0.50	0.24	1.0	0.3	1.3	0.29	2.0
July 23	168	47.5	24.9	13.7	2.3	0.52	0.24	1.0	0.3	0.8	0.27	1.7
July 23	173	22	24.9	30.8	2.1	0.50	0.22	2.7	0.3	5.1	0.10	0.9
June 29	182	19	24.8	15.9	2.3	0.60	0.20	1.2	0.3	1.5	0.19	1.8
July 23	184	22.5	24.9	14.7	3.1	0.60	0.40	2.8	0.5	5.0	0.18	1.7
June 28	192	21	24.8	15.9	2.0	0.50	0.20	1.5	0.4	1.6	0.14	2.5
July 23	197	29	25.0	18.9	2.7	0.45	0.40	2.5	0.4	4.1	0.27	2.1
June 22	741	52	25.0	15.8	2.0	0.50	0.20	1.4	0.3	1.0	0.24	1.4
July 23	742	19	25.0	14.4	2.2	0.50	0.24	1.2	0.3	0.8	0.14	1.6
July 18	743	40.5	25.0	14.4	2.2	0.50	0.24	1.2	0.3	0.9	0.15	1.5

TABLE 2

Bottom Temperatures derived from Reversing Thermometers in Generator Lake

Date of BT cast (1968)	BT slide #	Location Sediment Sample # (Fig. 2)	Temperature at bottom by Reversing Thermometer (°C)
June 12	1	1	1.7
June 12	2	2	1.4
June 13	3	3	1.3
June 16	4	4	1.1
June 18	5	5	1.4
June 22	6	6	1.5
June 28	7	7	1.3
June 29	8	8	1.3
July 23	9	9	1.3
July 23	10	10	1.5
July 23	11	10	---
July 23	12	11	1.3
July 23	13	12	1.2
July 23	14	13	1.5
July 23	15	14	1.8
July 23	16	15	1.4
July 27	17	17	1.4
July 27	18	18	1.3
July 27	19	19	1.4
July 27	20	20	1.3
July 27	21	21	1.4
July 27	22	4	---
July 27	23	3	---
July 27	24	2	---
July 27	25	6	---
July 27	26	1	---

Notes: Temperatures in column 4 are rounded to the nearest 1/10 of one degree.
Column 3: GSC sediment sample prefix BDA 68- has been omitted for brevity.

THE DATA

At each of a total of 20 stations the following data were collected: a bathythermograph trace, a water sample from immediately above the bottom, reversing thermometer readings at the same depth (Table 2) and, on a second cast, a bottom sediment sample by grab sampler. Six bathythermograph traces were repeat casts, as was one water sample. The water samples were analysed through the cooperation of the Water Quality Laboratory of the Inland Waters Branch and showed that the older northeast part of the lake basin (east end of profile 7) contained higher amounts of some dissolved salts than the western portion of the lake (Table 1). The bathythermograph traces are shown in section III of this report.

Plate 4 Bathythermograph and Knudson bottle beside sampling site. Two reversing thermometers are attached to the bottle.

SECTION II

TASIUJAQ COVE, EKALUGAD FIORD, BAFFIN ISLAND

GEOLOGICAL SURVEY OF CANADA

Tasiujaq Cove, Ekalugad Fiord, Baffin Island

Observers:

R. John Knight
Department of Geology
Queen's University, Kingston, Ontario

Michael Church
Department of Geography
University of British Columbia, Vancouver, B.C.

Division of Quaternary Research and Geomorphology

Plate 5   Aerial view of Tasiujaq Cove.

TASIUJAQ COVE

During the summers of 1967 and 1968, a field party from the Division of Quaternary Research and Geomorphology, Geological Survey of Canada, engaged in studies of recent alluvial sedimentation at the head of Ekalugad Fiord (frontispiece) on the Home Bay coast of Baffin Island (GSC project 680042). In conjunction with this survey, investigations were made of the bathymetry and bottom sediments in Tasiujaq Cove (Fig. 5).

Tasiujaq Cove is the shallowest of three basins in the Sarvalik arm of Ekalugad Fiord (Fig. 6). While the sill at the outer end of the arm is bedrock, the next may be morainic, like that separating Tasiujaq Cove. This moraine was deposited underwater about 6100 years ago (Andrews, 1969) by the last Pleistocene ice tongue to occupy the valley. By 5700 years B.P. the ice had retreated to the head of Ekalugad valley (6.8 km upvalley) and alluvial deposition began into the fiordhead from this position. The moraine probably emerged about 4500 years ago, so that the circulation between the cove and the Sarvalik Fiord has been restricted through most of its history.

The delta being deposited at the distal end of the alluvial outwash plain continues to encroach slowly into the cove; it is now about 2.25 km long and 1.85 km wide at its widest. The deepest point, determined from soundings, is 70 m and the mean depth is 39.7 m; the surface area is 3.61 km^2. The channel connecting the cove with the fiord is only 3 m deep and is floored by large boulders that are lag deposits from the eroded moraine.

Freshwater enters at the head between late June and early September from three rivers with maximum runoff during the snowmelt period in early July and during summer rainstorms. The average daily influx of water during the 1967 season was 4.24×10^6 m^3 with a maximum daily influx of 16.79×10^6 m^3 on July 14. In the low runoff season of 1968 only about 1/4 as much runoff was observed.

In 1967 soundings of the delta foreslope were made by lead line, with positions fixed by simultaneous theodolite observations from shore. In 1968 echo sounding was carried out. Positions were fixed periodically along the boat track from sights on a series of "range" markers on shore. The bathymetric map (Fig. 5) was subsequently drawn by interpolating contours amongst the track profiles plotted on the map.

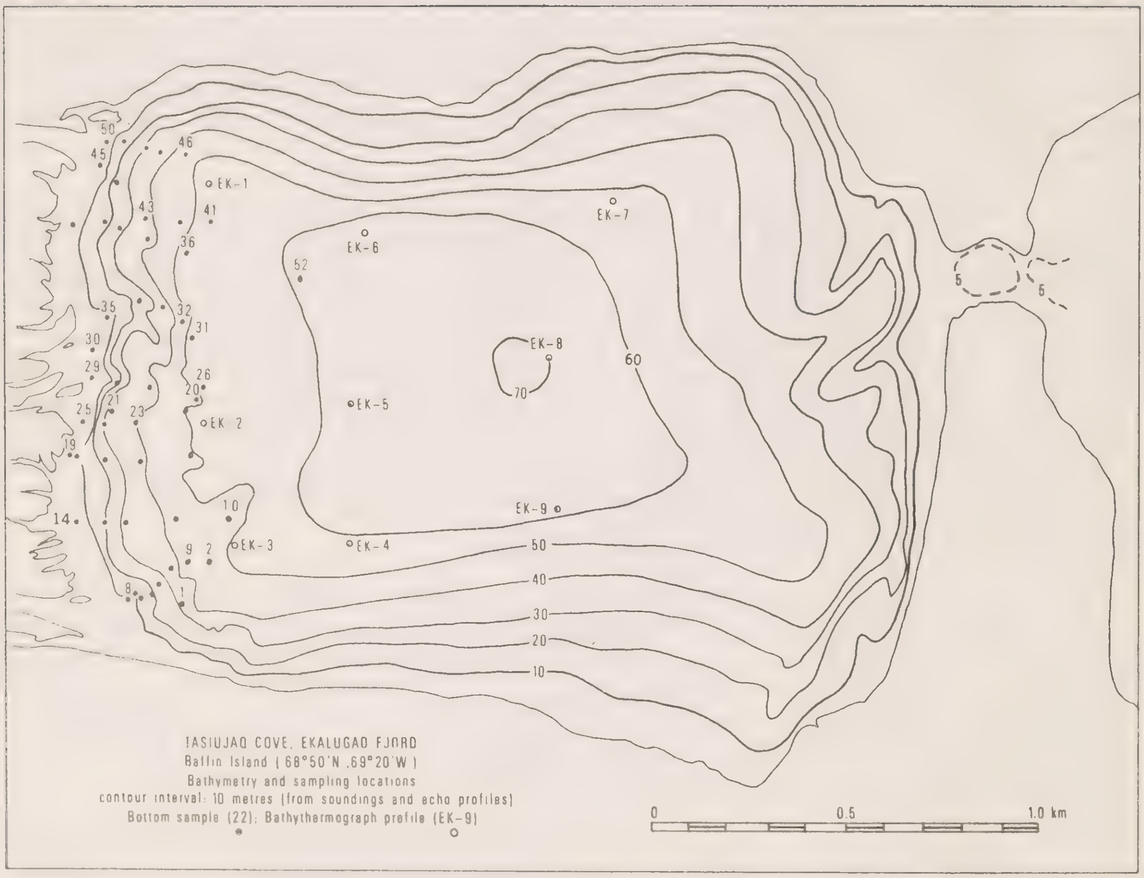

Figure 5 Location of stations within Tasiujaq Cove indicating the bathymetry and sampling locations.

A tide gauge with a pressure transducing sensor was set up in 1967 near the northwest corner of the cove, and records maintained between July 22 and August 15. The tide appeared to be basically diurnal, but with a double high tide often occurring. High tide characteristically occurred early in the morning. For the period of record the average daily tidal range was 0.84 m: the maximum was 1.03 m and the minumum, 0.58. Without considering freshwater discharge from the rivers, the average tide would require a daily movement into and out of the cove of 3.05×10^6 m^3 of water. In view of the data presented above, it appears that the stream discharge may affect the water levels during periods of significant runoff. Water level data are available from the observers.

The cove is ice covered for about 9 to 10 months of the year, opening only between late July and the end of September. The channel at the moraine may or may not freeze over; in the winter of 1966-67 the tidal exchange apparently maintained open water there.

Temperature profiles were obtained using a bathythermograph at the nine stations shown on Fig. 5. Two reversing thermometers were used to determine the water temperature at water sampling positions. The temperatures reported in Table 3 represent the mean of the two thermometers, after corrections. The mean discrepancy between the two thermometers was 0.03°C and the maximum discrepancy was 0.06°C. Surface water temperatures were read with an ordinary thermometer divided in 1/10ths °C.

All the results reported in Table 3 were obtained on August 20, 1968.

Water samples were taken in each BT profile, from two to five samples being taken in each. Surface samples were dipped from the water and the others were obtained using a Knudsen bottle.

Analyses were undertaken at the Industrial Waters Laboratory, Water Quality Division of Inland Waters Branch. Complete analysis was carried out on 13 of the samples and the specific conductance determined for the remainder with a multiple range conductivity meter.

All data are given in parts per million. Salinity is obtained by taking 10^{-3} x the sum of major constituents as given in the table. "Total hardness" is the total of hardness producing ions expressed as $CaCO_3$ equivalents ppm. Here, Ca^{++} and Mg^{++} are considered.

TABLE 3

DATA FROM CHEMICAL ANALYSIS OF WATER SAMPLES TAKEN AT TASIUJAQ COVE, EKALUGAD FIORD, BAFFIN ISLAND, N.W.T.

St No	Depth (M)	(°C)	Specific Conductance	Total Hardness	Ca	Mg	Na	K	Cl	NO_3	Sio_2	Sum of Major Constituents
1	sfc.	5.2	1,280	111.0	8.0	22.0	182	10.0	332	0.06	0.70	554.76
	13.7	-0.63	45,600	5,830	340	1,210	9,400	480	16,600			28,021
	27.7	-1.37		no data								
	41.5	-1.40	48,200									
	54.8	-1.40	47,700									
2	sfc.	5.2	982	90.3	6.5	18.0	145	7.8	265	0.05	0.60	442.95
	13.7	-0.84	48,400	6,060	350	1,260.	10,000	510	18,000			30,120
	27.7	-1.33	48,700	6,061	350	1,260	10,000	510	18,150			30,271
	41.5	-1.46	48,700	6,060	350	1,260	10,000	510	18,150			30,270
	56.9	-1.39	48,200	6,020	350	1,250	10,000	510	18,000			30,110
3	sfc.	5.2	790	57.8	5.0	11.0	92	5.2	170	0.00	1.20	284.40
	13.7	-0.77	48,600	6,090	360	1,260	10,000	510	18,000			30,130
	27.7	-1.37	48,200									
	41.5	-1.46	48,200									
	53.9	-1.44	48,200									
4	sfc.	5.2	1,000									
	58.4	-1.42	48,200	6,090	360	1,260	10,000	510	18,150			30,280
5	sfc.	5.2	690	51.9	5.0	12.0	97.5	5.4	186	0.05	1.10	307.05
	61.6	-1.44	48,700									
6	sfc.	5.2	1,110									
	64.7	-1.41	48,200									
7	sfc.	5.5	1,120									
	53.8	-1.43	50,000									
8	sfc.	5.3	1,505	65.8	8.2	11.0	222.0	10.5	418	0.05	2.30	672.05
	18.2	-1.11	48,200	6,060	350	1,260	10,000	510	18,050			30,170
	36.8	-1.38	48,300									
	55.4	-1.45	49,000									
	69.4	-1.36	48,200									
9	sfc.	5.2	1,440									
	63.1	-1.41	48,200									

TABLE 3 (continued)

Station	Specific Conductance	Total Hardness	Ca	mg	Na	K	Cl	NO_3	SiO_2	Sum of Major Constituents
North River	12.40	2.50	0.60	0.24	0.50	0.30	0.50	0.07	1.50	7.20
Middle River	15.30	3.30	0.90	0.20	0.30	0.30	0.10	0.05	1.50	8.60
South River	24.40	6.90	2.30	0.30	0.50	0.50	0.90	0.05	1.80	14.60

The samples were stored between August 20, 1968 and February 17, 1969, when they were analyzed. They were retained in sealed, glass sample bottles during this period. Three freshwater samples analyses of water from the inflowing rivers are appended for comparative purposes.

The bottom samples were obtained using a Dietz-Lafond grab sampler. Mechanical analysis was carried out in the Sedimentology Laboratory of the Division of Quaternary Research and Geomorphology, Geological Survey of Canada. Dry sieves were used to 0.44 mm, after which pipette analyses were carried out as necessary. Table 4 shows the results.

Little oceanographic work has been done in the Baffin Island fiords. Elsewhere fiords have been studied in considerable detail. The interest of the present investigations lies in the possibility that Tasiujaq Cove could, in the future, become isolated from the sea, under the aegis of continued post-glacial uplift, and form a lake.

R.J. Knight
M. Church

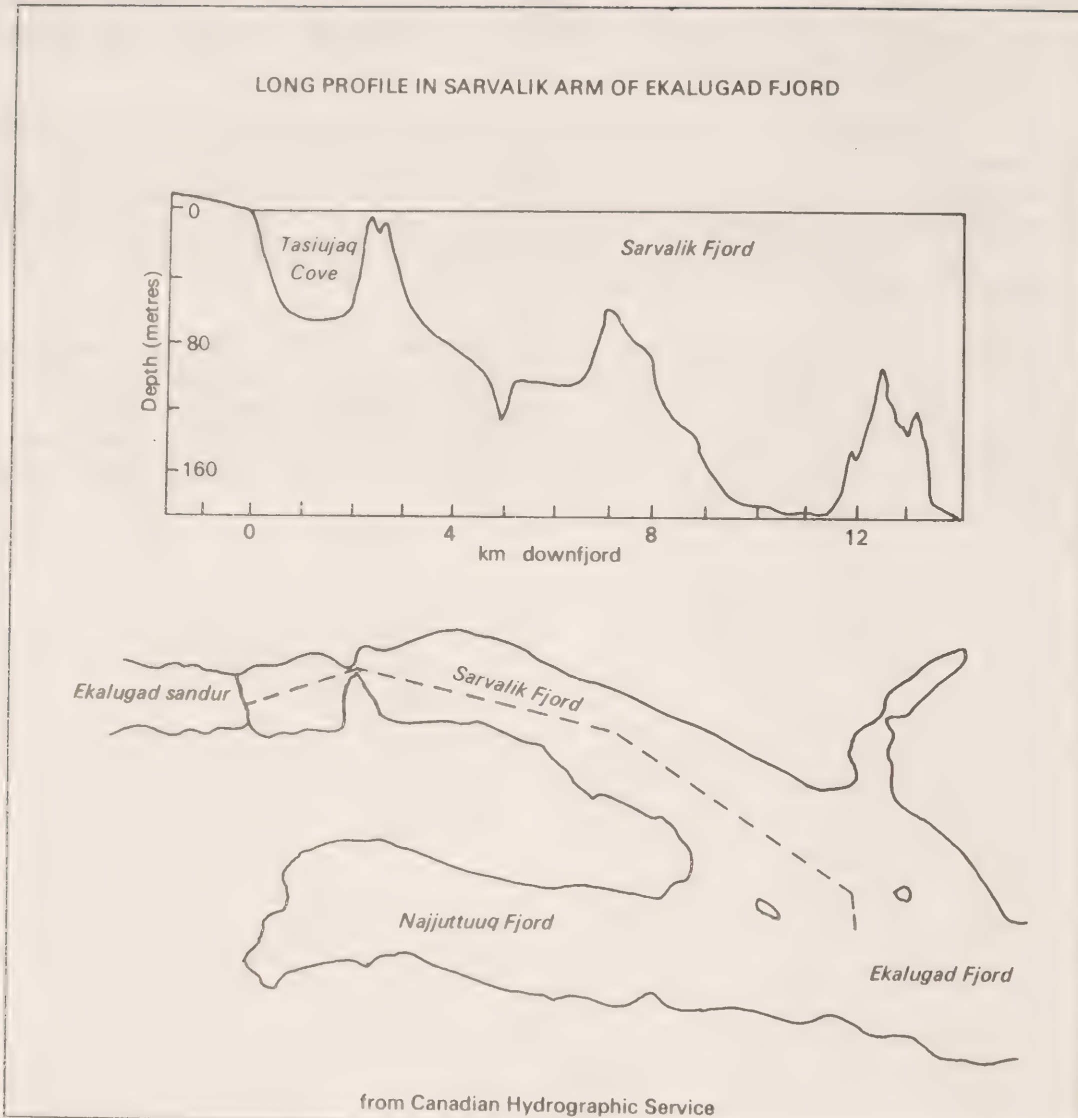

Figure 6 Place names and depth profile in the seaward approach to Tasiujaq Cove.

TABLE 4

Grain Size Data of Bottom Samples

Sample No.	Water Depth (metres)	Percentage of Total			Percentage of Fines		
		32-8 mm	8-2 mm	<2 mm	Sand	Silt	Clay
01	32.56			100.0	62.05	31.66	6.29
02	44.37			100.0	70.31	24.54	5.15
03	37.86			100.0	71.79	22.12	6.09
04	26.20			100.0	62.98	30.92	6.10
05	19.85	66.9	4.4	28.4	91.23	6.18	2.59
06	15.87	70.2	11.5	18.1	93.51	6.49	
07	7.02	17.4	34.9	47.5	98.88	1.12	
08	1.51	59.7	14.7	25.3	99.58	0.42	
09	46.91			100.0	63.43	30.61	5.96
10	46.44			100.0	58.49	34.73	6.78
11	42.92			100.0	40.15	49.91	9.94
12	31.78			100.0	45.39	44.39	10.22
13	20.34	2.0	5.4	92.3	55.06	36.22	8.72
14	7.15	38.3	5.0	56.4	67.28	27.02	5.70
15	49.26			100.0	21.06	66.03	12.91
16	37.45			100.0	44.95	46.32	8.73
17	26.37			100.0	49.28	43.25	7.47
18	12.64			100.0	38.49	50.85	10.66
19	4.24		0.3	99.6	66.85	26.91	6.24
20	49.73			100.0	48.55	43.22	8.23
21	34.63			100.0	58.84	35.44	5.72
23	40.13			100.0	64.36	30.55	5.09
24	33.67		0.3	99.6	87.24	9.59	3.17
25	3.54	9.8	19.9	70.1	99.99	0.01	
26	53.83			100.0	35.53	56.67	7.80
27	36.30			100.0	69.67	25.52	4.81
28	11.21			100.0	85.40	11.39	3.21
29	1.19		0.5	99.4	97.17	1.21	1.62
30	1.61	0.9	18.1	80.8	99.80	0.20	
31	53.04			100.0	46.41	47.02	6.57
32	40.08			100.0	57.80	36.69	5.51
33	31.69			100.0	50.90	42.61	6.49
34	18.73			100.0	52.65	40.26	7.09
35	1.58	0.5	5.8	93.5	94.93	3.24	1.83
36	54.53			100.0	50.42	42.95	6.63
37	33.19			100.0	58.76	35.91	5.33
38	25.56			100.0	58.12	35.96	5.92
39	16.41			100.0	47.93	45.33	6.73
40	1.58		0.2	99.7	91.99	5.93	2.08
41	53.56			100.0	49.85	44.20	5.95
42	45.94		0.1	99.8	58.23	34.17	7.60
43	36.80		0.1	99.8	89.53	9.18	1.29
44	26.29		14.4	85.5	84.34	13.75	1.91
45	5.57		0.1	99.8	61.26	29.60	9.14
46	48.24			100.0	67.24	28.98	3.78
47	33.72			100.0	62.89	32.39	4.72
48	32.95			100.0	87.83	10.30	1.87
49	16.96	6.8	2.6	90.2	81.17	16.52	2.31
50	5.53	9.0	0.1	90.8	84.78	13.39	1.83
52	61.74		0.2	99.7	28.73	60.06	11.21

Plate 6 Boat and equipment used in the collection of the field data at Tasiujaq Cove.

Plate 7 View from North River estuary looking into Tasiujaq Cove.

ACKNOWLEDGEMENTS

Agencies of the Department of Energy, Mines and Resources which made equipment available included the Canada Centre for Inland Waters, the Polar Continental Shelf Project and the Canadian Hydrographic Service; staff of the Marine Sciences Branch assisted and encouraged the preparation of the data record. Wayne Brydges of Atlantic Helicopters kindly volunteered both time and technical skill in assisting with part of the sampling programme.

SECTION III

BATHYTHERMOGRAMS

GENERATOR LAKE

The number on each refers to the station number of Table 1 and the locations of Figure 3.


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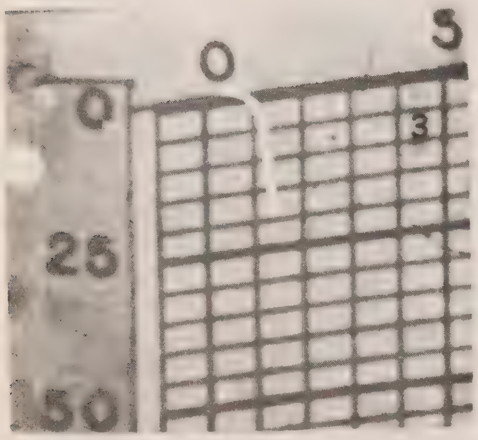
2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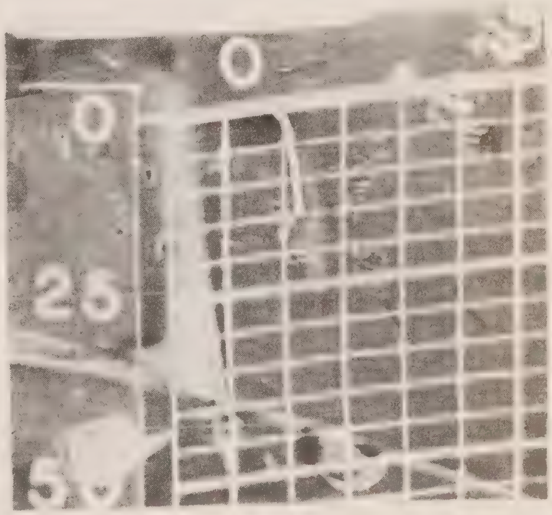
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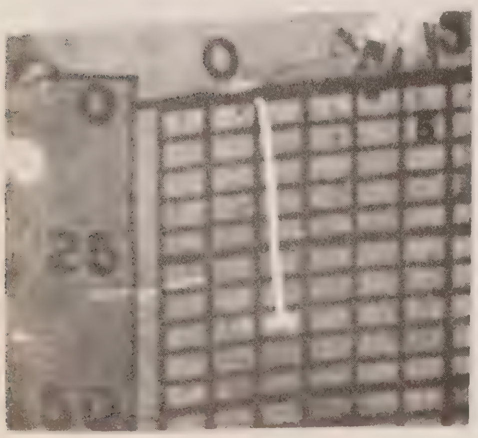
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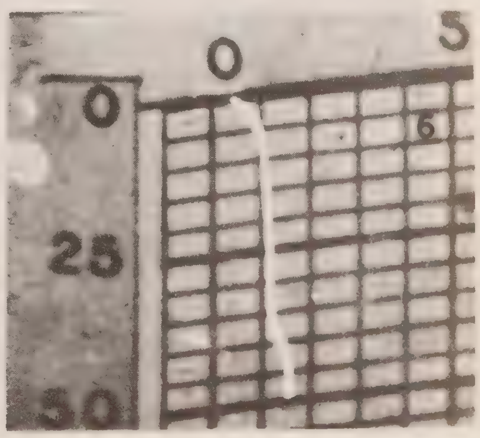
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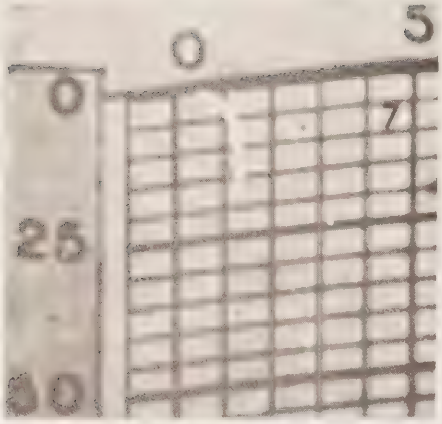
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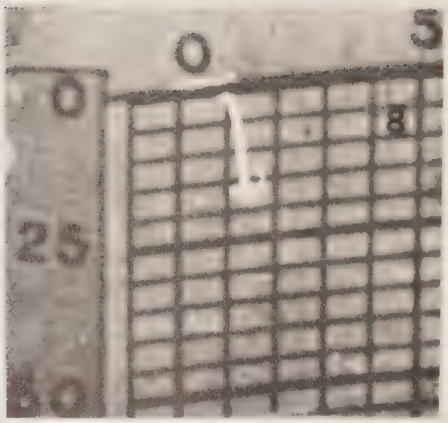
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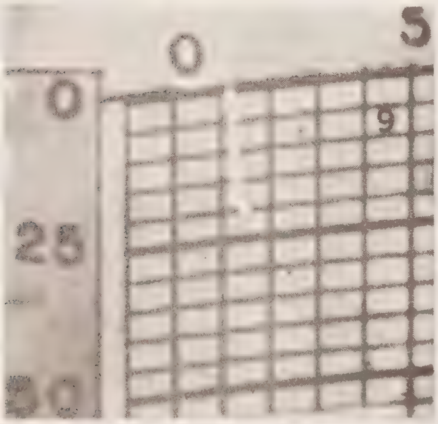
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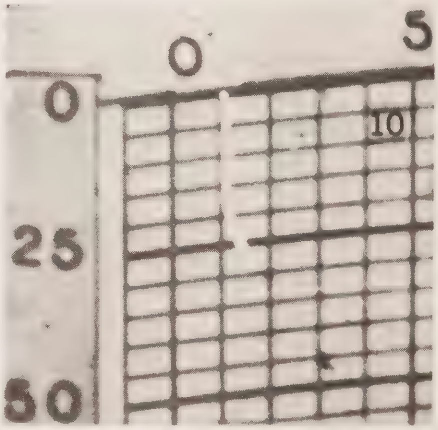
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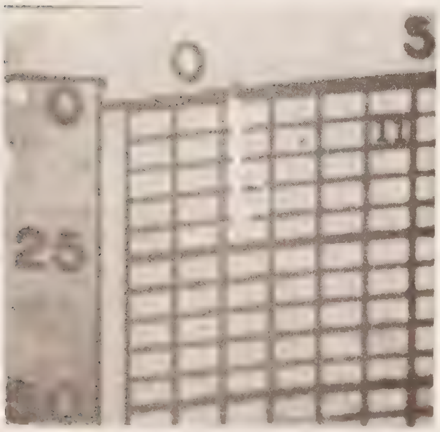
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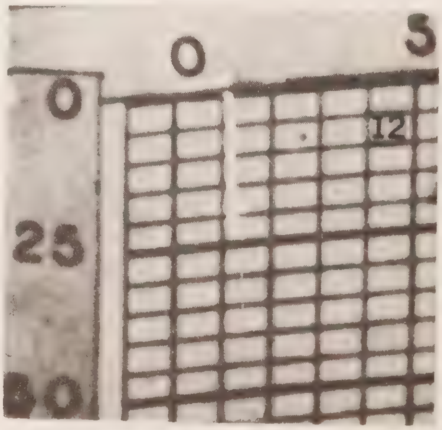
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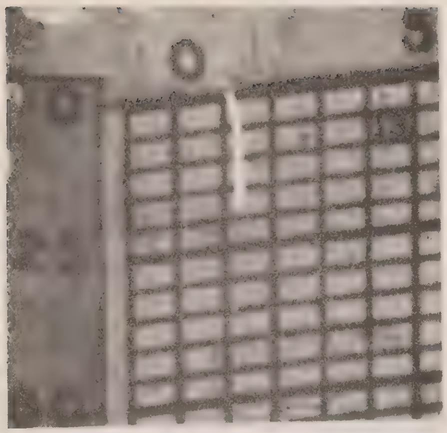
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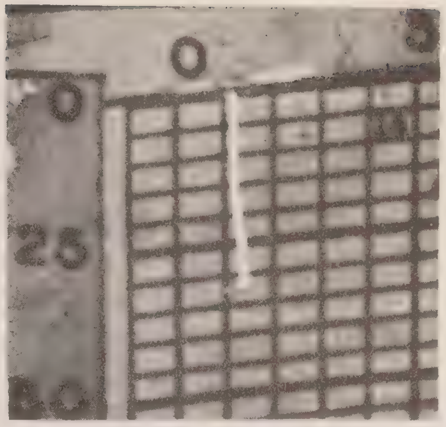
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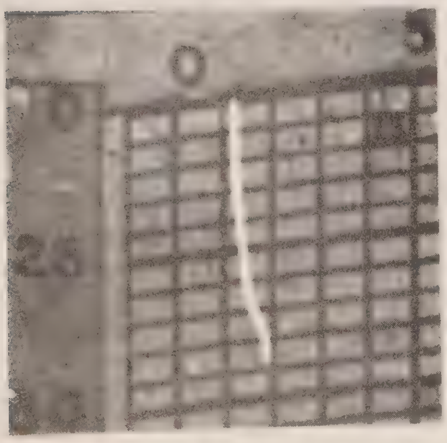
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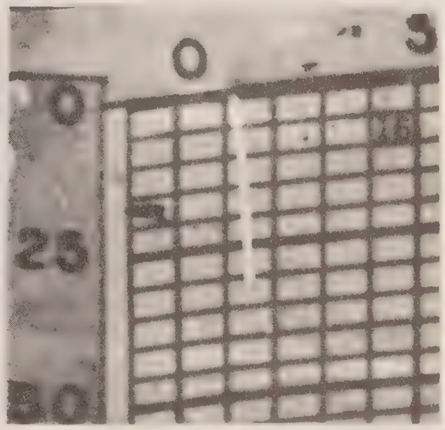
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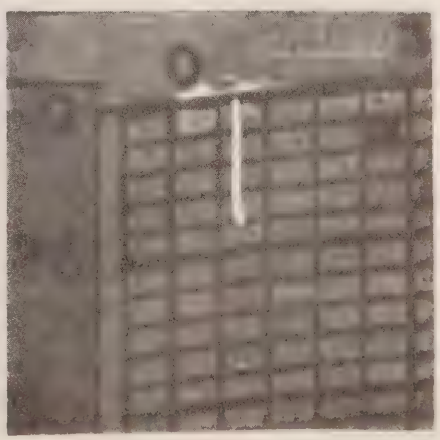
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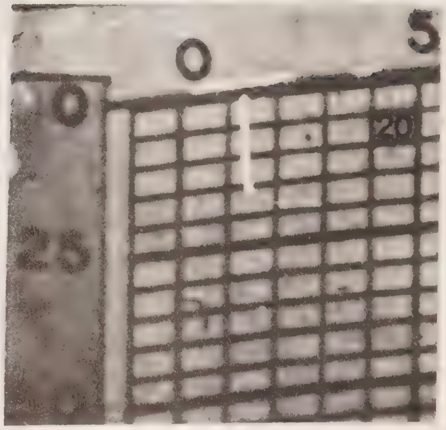
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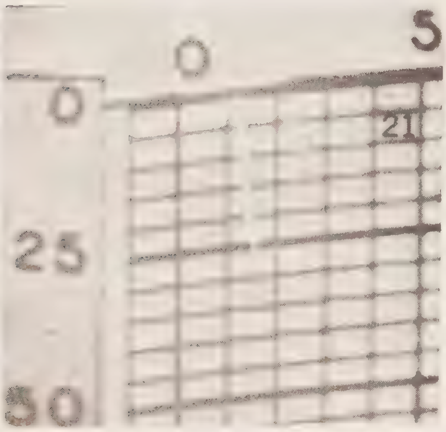
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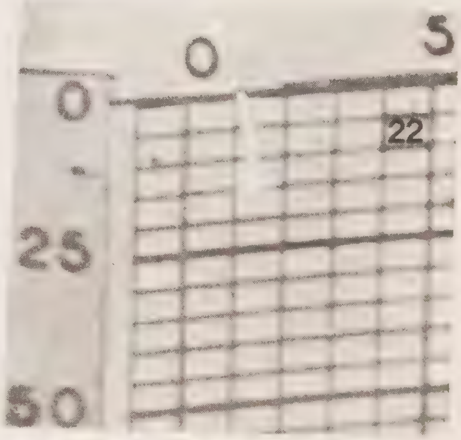
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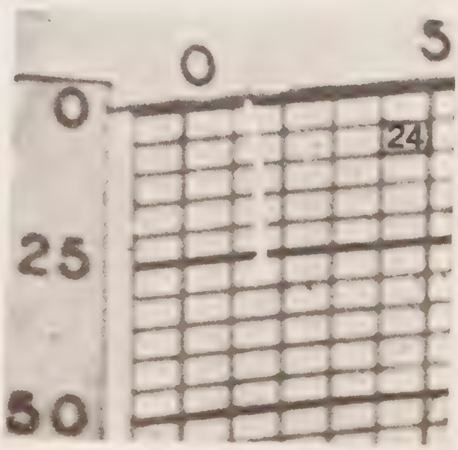
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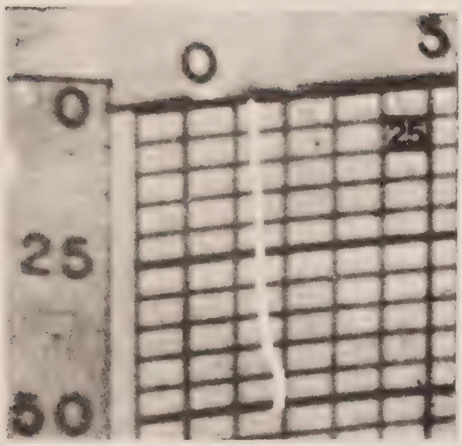
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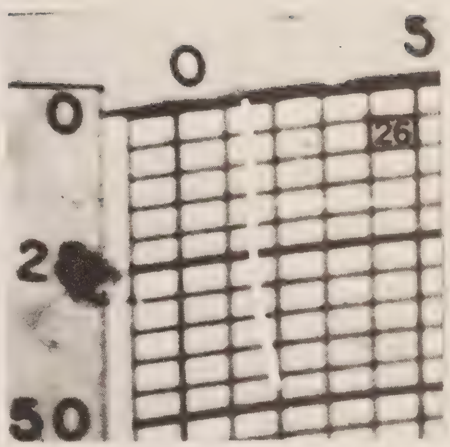
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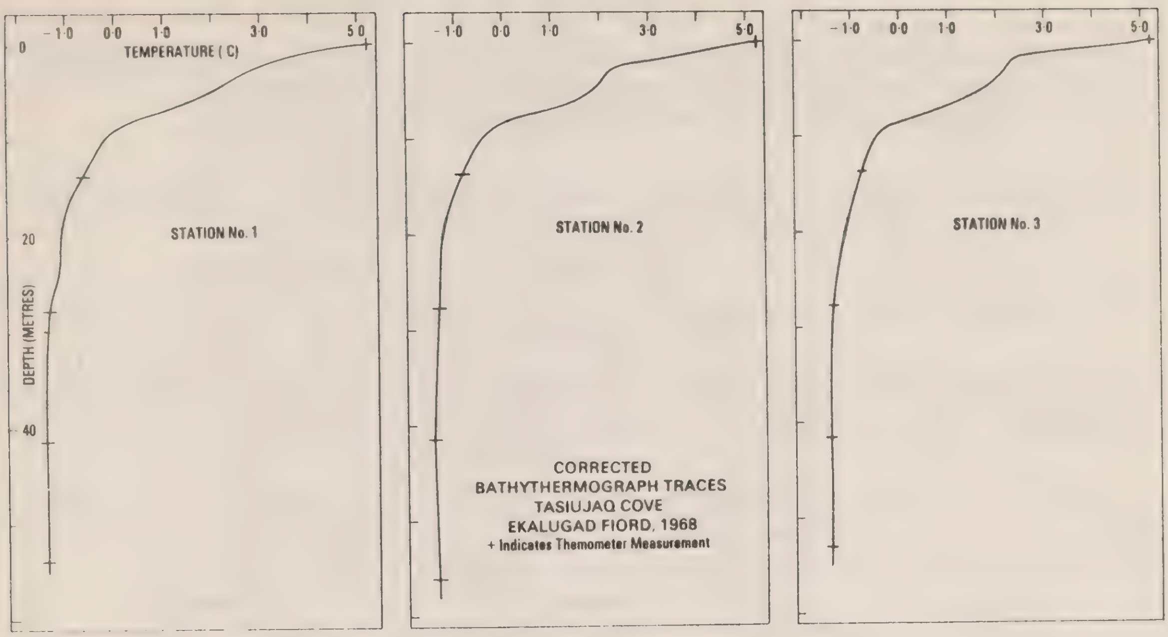
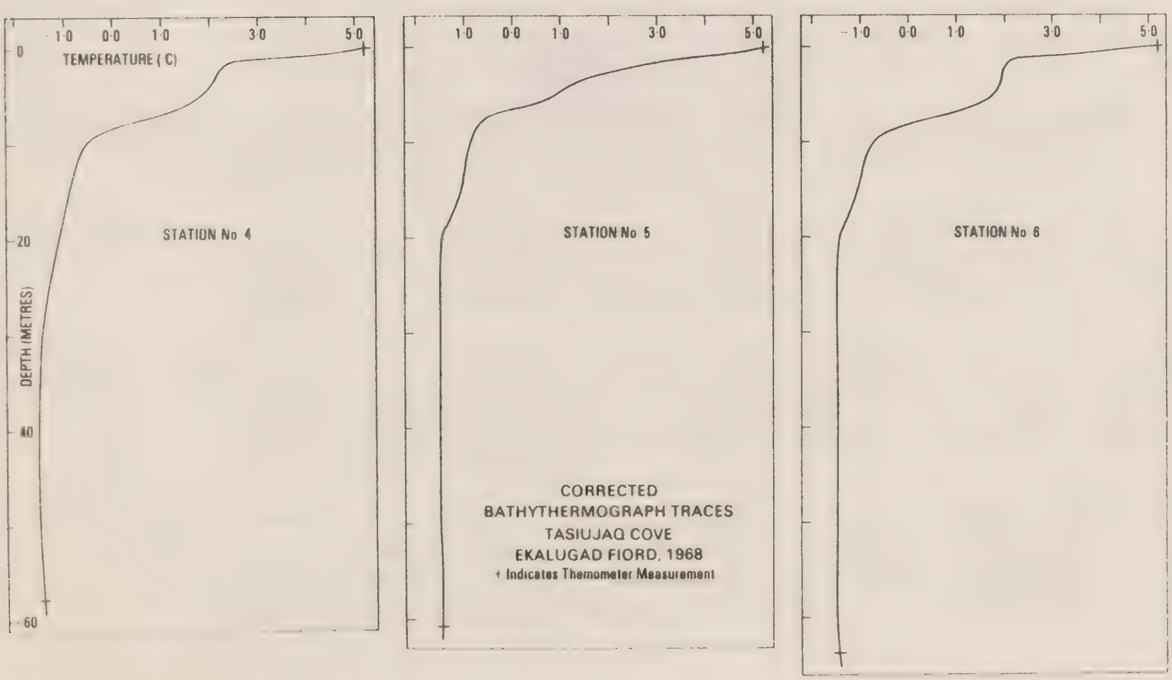
TASIUJAQ COVE

The number on each refers to the station number of Table 3 and of Figure 5.



CORRECTED
BATHYTHERMOGRAPH TRACES
TASIUJAQ COVE
EKALUGAD FIORD, 1968
+ Indicates Themometer Measurement



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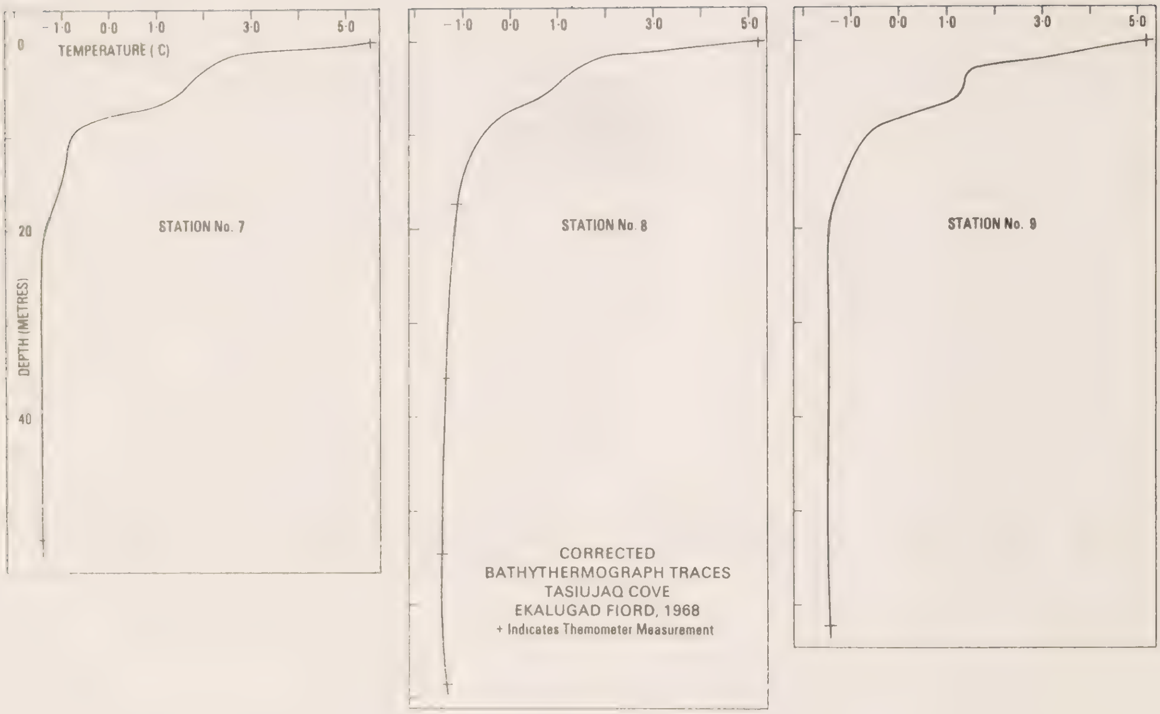

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